

$$(1+Ha)f' + Grf'^2 = \theta - NrS \quad (1)$$

$$\theta'' + \frac{1}{2}f\theta' + Nb\theta'S' + Nt\theta'^2 = \varepsilon f' + \varepsilon \left( f' \frac{\partial \theta}{\partial \varepsilon} - \theta' \frac{\partial f}{\partial \varepsilon} \right) \quad (2)$$

$$S'' + \frac{1}{2}Le f S' + \frac{Nt}{Nb} \theta'' = Le \varepsilon \left( f' \frac{\partial S}{\partial \varepsilon} - S' \frac{\partial f}{\partial \varepsilon} \right) \quad (3)$$

Boundary conditions

$$\eta = 0: f(\varepsilon, 0) = -2\varepsilon \frac{\partial f}{\partial \varepsilon}, \theta'(\varepsilon, 0) = -Bi\varepsilon^{1/2} [1 - \theta(\varepsilon, 0) - \varepsilon], S(\varepsilon, 0) = 1 \quad (4)$$

$$\eta \rightarrow \infty: f'(\varepsilon, \infty) \rightarrow 0, \theta(\varepsilon, \infty) \rightarrow 0, S(\varepsilon, \infty) \rightarrow 0 \quad (5)$$